MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

DCS5068-DATA STRUCTURE & ALGORITHMS
(DIT)

4 JUNE 2018
2.30 pm – 4.30 pm
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **7** pages.

2. Answer **ALL** questions in the answer booklet provided.

Instruction: Write your answers in the answer booklet provided. Total is **100 marks**.

QUESTION 1

a) Given a C++ program below:

```
int main()
{
int n[] = {645,873};
for ( int i=0; i<2; i++)
{
cout<<"Original Value index " << i<< "  is:  "<< n[i] <<"\n";
cout<<"After entering mystery function = "<< mystery (n[i])<<"\n";
}
      return 0;
}

int mystery (int n)
{ int r = 0;
  while ( n> 0 )
  { r = 10* r + n%10;
  n /= 10;
  }
  return r;
}
```

    i)   Write the output of the following C++ program.   (6 marks)

b) Given the program below:

```
#include <iostream>
using namespace std;
...............(a) ...............

int main()
{
    Person p1;
    int i;
    float tpoints, cgpa;
    tpoints = 0;

    cout << "Enter full name: ";
    cin>>p1.name;
    for ( i = 0; i<2;i++)
    {
      cout << "Enter Subject: ";
      cin >> p1.subject[i];
```

```
        cout << "Enter total marks: ";
        cin >> p1.marks[i];

        ...............(b) ................

        ...............(c) ................
      }
          cgpa = tpoints / 2;
        ...............(d) ................
          return 0;
    }
```

Sample output screen

```
Enter full name        : Azlina
Enter Subject       : Data Structure
Enter total marks     : 88
Enter Subject       : Java
Enter total marks      : 55.9

Displaying Information.
Hi       : Azlina
Subject     : Data Structure
Total marks     : 88
Grade: A
Subject     : Java
Total marks      : 55.9
Grade: C
CGPA: 3
```

[**Note:** Refer to sample output given. The **bold** items are the inputs entered by user]

i)   At segment labelled *'(a)'*, declare a *structure* named *Person* which consists of five
     data members:
     - *name (string)*
     - *Subject [5] (string)*
     - *marks [5] (float)*
     - *grade [5] (char)*
     - *points [5] (float)*

                                                                              (3 marks)

Continued ...

ii) At segment labelled *'(b)'*, write an *if....else* statement to determine the grade and the points from the marks entered. Store both the each individual grade and the point at each variable *grade[]* and *points[]*.   (8 marks)

Marks	Grade	Points
80<= marks <=100	A	4
60<= marks <80	B	3
50<= marks <60	C	2
marks <50	F	1

iii) At segment labelled *'(c)'*, write the formula to total the collected points for two subjects and save it at *tpoints*.   (1 mark)

iv) At segment labelled *'(d)'*, write the code segment to display the output as shown in the sample output.   (7 marks)

[Total 25 marks]

QUESTION 2

a) Given the following postfix notation:

$$2 \quad 3 \quad + \quad 8 \quad * \quad 10 \quad 6 \quad - \quad /$$

i) Convert into infix notation and write the final value.   (2 marks)

ii) Write prefix notation from the infix notation derived in Question 2(a)(i).   (2 marks)

Continued ...

b) Complete the following program to add (push) an element into a stack.   (4 marks)

```
class ADTstack                          void push(int num)
{                                       {
private:                                if (_____(i)_____)
   int stack[5];                        {
   int topstack;                              _____(ii)_____
public:                                        _____(iii)_____
   ADTstack()                           }
   {                                    else
   topstack = -1;                          cout<<"Stack is Full"<<endl;
   }                                    }
   int full()                          };
   {                                    void main()
   if(topstack==9)                      {
      return 1;                              _____(iv)_____
   else                                 st.push(23);
      return 0;                         st.push(46);
   }                                    }
```

c) **Table 1** below represents an array implementation of a linked list.

   i) Complete the following table so that the list are sorted in **ascending** order. Take 0
       as the start index and 99 as dummy to represent the end of list.   (4 marks)

Index	Data	Link
0	10	
1	20	
2	15	
3	25	

Table 1

   ii) Based on the answer in **2c(i)**, draw an updated table after data **18** is added.
                                                                                  (2 marks)
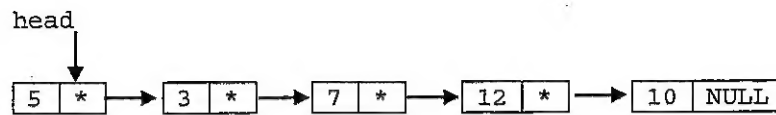
d) Consider a linked list represented by the following declaration and diagram:

```
struct node
{
   int data;
   node *next;
}*head, *prev, *temp;
```

Continued ...

head

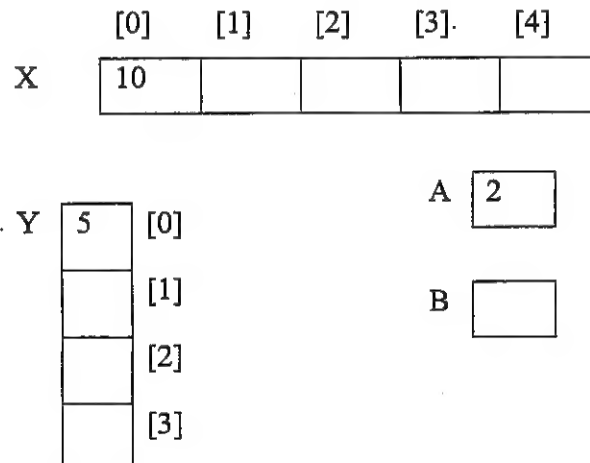| 5 | * | → | 3 | * | → | 7 | * | → | 12 | * | → | 10 | NULL |

Draw an updated diagram after the following lines of code have been executed.

(5 marks)

```
1. prev = head->next;
2. temp = new node;
3. temp->data = 4;
4. temp->next = prev->next;
5. prev->next = temp;
```

e) *X* is a queue of integers with five elements and *Y* is a stack of integers with four elements. There are two integers *A* and *B*.

         [0]   [1]   [2]   [3]   [4]

X | 10 | | | | |

A | 2 |

Y | 5 | [0]

    | | [1]   B | |

    | | [2]

    | | [3]

Draw the sequence diagrams of *A, B, X* and *Y* after each of the following operations:

    i)   X.append(Y.pop( ));   (1 mark)

    ii)   B = X.serve( ) * A;   (1 mark)

    iii) Y.push(25);   (1 mark)

    iv) X.append(A - B);   (1 mark)

    v)   if(X.serve()< Y.pop())   (2 marks)

         X.append(A);

[Total 25 marks]

Continued ...

QUESTION 3

a) Given an array contains the elements shown in the diagram below. By using **Insertion Sort**, sort the following sequence of number in **ascending order.** Draw the sequence of diagram to depict the process.   (6 marks)

63	50	18	74	92	28

b) By using binary search, show the step by step how to find '**83**' from the following integer in the array given.   (9 marks)

Array:	34	51	83	98	134	164	207
Index:	0	1	2	3	4	5	6

c) Assume a hash table with **8** locations and the hashing function $h(x) = x \% 8$. Show the index for each key and the result of the hash table when the following integers are inserted in the order given. Use Channing method to solve the collision.
       (10 marks)

126, 82, 47, 684, 223, 540, 793, 477

[Total 25 marks]

QUESTION 4

a) Answer all of the following questions based on tree given in **Figure 1**.
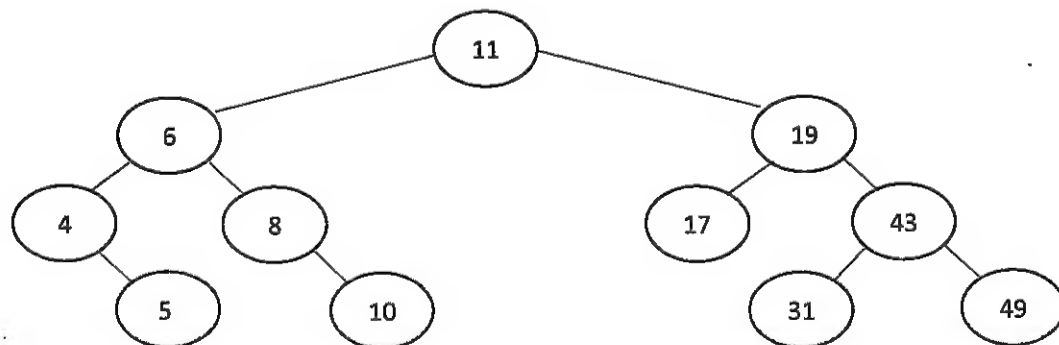

Figure 1

i) Write the *InOrder* and *PostOrder* traversal.   (4 marks)

Continued ...

ii) Draw the binary tree after deleting node with the smallest value.   (2 marks)

iii) Draw the binary tree after adding node with value '20'.   (2 marks)

iv) List all leaf nodes.   (2 marks)

v) If the node '11' is deleted, which node will be the new root?   (1 mark)

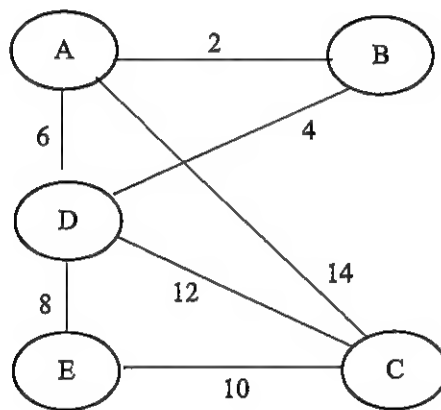b) Answer the following questions based on the graph in **Figure 2**.

Figure 2

i) What is the type of graph in **Figure 2**?   (2 marks)

ii) How many simple cycle with length three can you identify from the graph? List out any **TWO** cycle identified.   (3 marks)

iii) Write the adjacency matrix for the graph in **Figure 2**.   (9 marks)

[Total 25 marks]

End of Page.